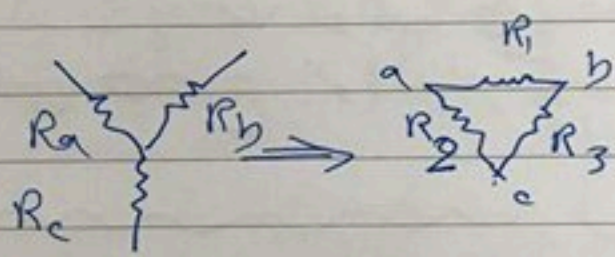


$$R_a = \frac{R_1 R_3}{R_1 + R_2 + R_3} \Rightarrow Z_a = \frac{Z_1 Z_3}{Z_1 + Z_2 + Z_3}$$

$$R_b = \frac{R_1 R_2}{R_1 + R_2 + R_3} \Rightarrow Z_b = \frac{Z_1 Z_2}{Z_1 + Z_2 + Z_3}$$

$$R_c = \frac{R_2 R_3}{R_1 + R_2 + R_3} \Rightarrow Z_c = \frac{Z_2 Z_3}{Z_1 + Z_2 + Z_3}$$



$$R_1 = R_a + R_b + \frac{R_a R_b}{R_c}, \quad Z_1 = Z_a + Z_b + \frac{Z_a Z_b}{Z_c}$$

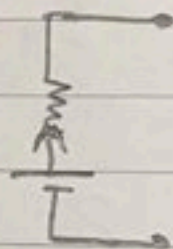
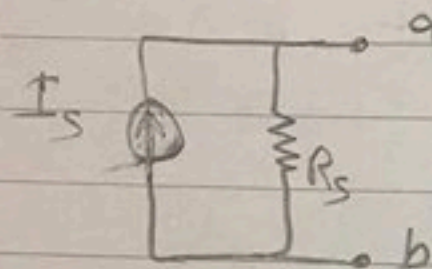
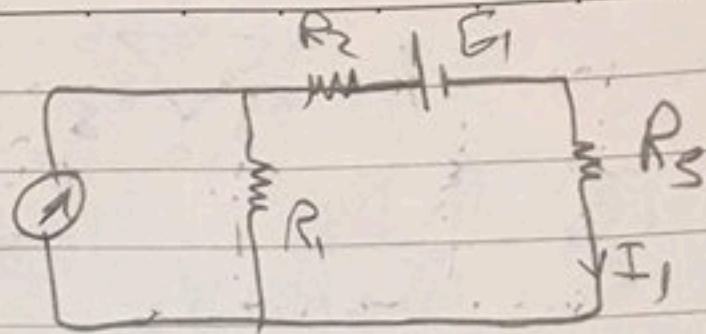
$$R_2 = R_a + R_c + \frac{R_a R_c}{R_b}, \quad Z_2 = Z_a + Z_c + \frac{Z_a Z_c}{Z_b}$$

$$R_3 = R_b + R_c + \frac{R_b R_c}{R_a}, \quad Z_3 = Z_b + Z_c + \frac{Z_b Z_c}{Z_a}$$



$$I_1 = ??$$

⇒ Method of Analysis  
① Sources Conversion



$$V_s = I_s R_s$$

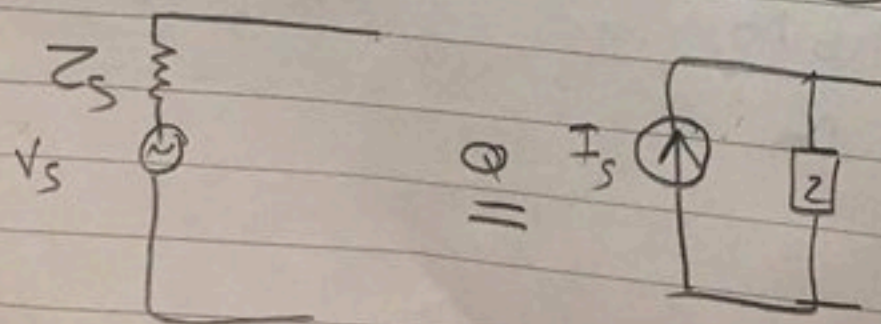
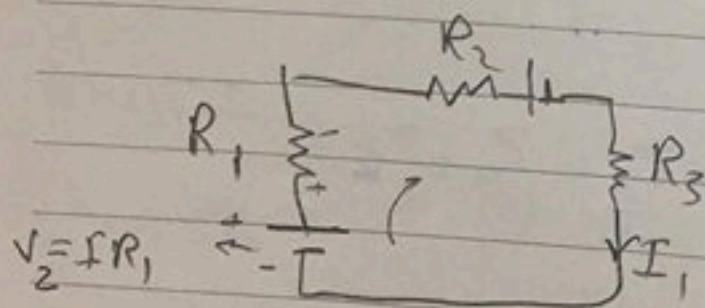
أي Current.S متصل توازي مع مقاومة  
يمكن تحويله لـ Voltage.S متوالي مع نفس المقاومة  
والعكس صحيح "والتيار يكون في نفس الاتجاه"

Note

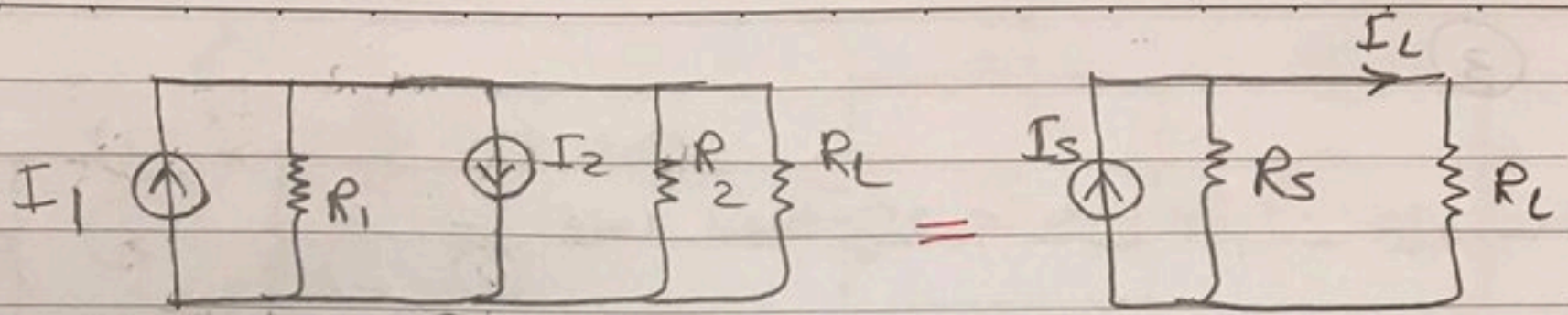
(Solution)

$$C.S \rightarrow V_s$$

$$E_2 - I_1 R_1 - I_1 R_2 - E_1 - I_1 R_3 = 0$$





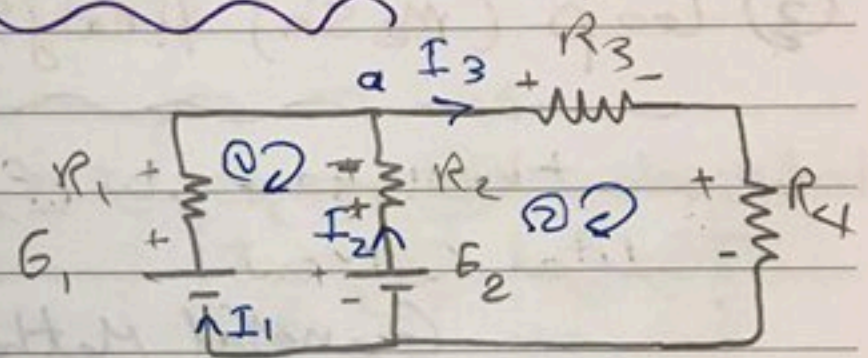


Assume  $I_1 > I_2$

$$I_s = I_1 - I_2 \quad R_s = R_1 \parallel R_2$$

element's is power analysis

② Branch Current analysis



$$L = b - n + 1 = 3 - 2 + 1 = 1$$

↓ independent loop

K.V.L 1

$$E_1 - I_1 R_1 + I_2 R_2 - E_2 = 0 \rightarrow \textcircled{1}$$

K.V.L 2

$$E_2 - I_2 R_2 - I_3 R_3 - I_3 R_4 = 0 \rightarrow \textcircled{2}$$

K.C.L at a

$$I_1 + I_2 = I_3 \rightarrow \textcircled{3}$$

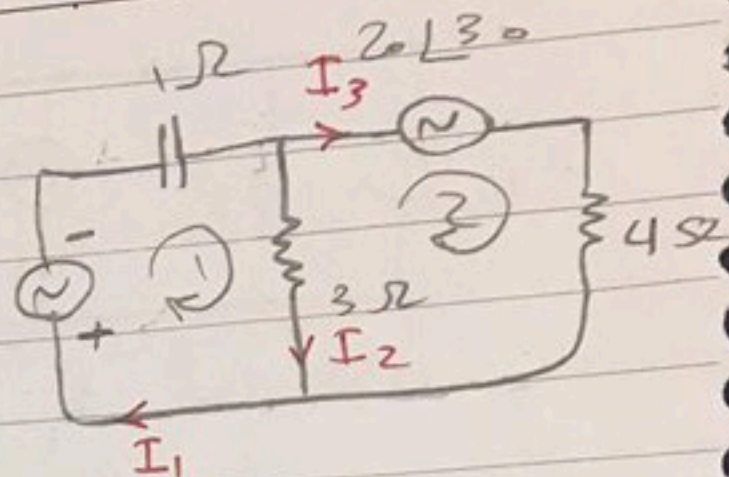


③

$$-10 \angle 0^\circ - I_1(1) - 90 - 3I_2 = 0 \quad \text{①}$$

$$20 \angle 30^\circ - 4I_3 + I_2 + 3 = 0 \rightarrow \text{②}$$

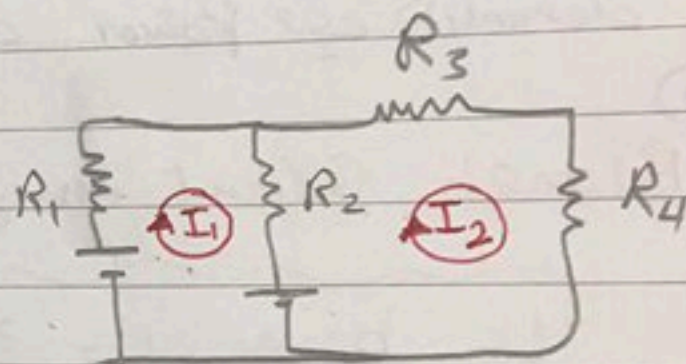
$$I_1 = I_2 + I_3 \rightarrow \text{③}$$



### ③ Loop (mesh) Analysis

independent loop \*  
Circulated current

General Method.



$$\Rightarrow E_1 - I_1 R_1 - (I_1 + I_2) R_2 - E_2 = 0$$

$$\Rightarrow I_1 (R_1 + R_2) - R_2 I_2 = E_1 - E_2 \rightarrow \text{①}$$

$$\Rightarrow E_2 - (I_2 - I_1) R_2 - I_2 (R_3 + R_4) = 0$$

$$-R_2 I_1 + (R_2 + R_3 + R_4) I_2 = E_2 \rightarrow \text{②}$$

Formal method

For loop 1

$$-I_2 R_2 + I_1 (R_1 + R_2) = E_1 - E_2$$

For loop 2

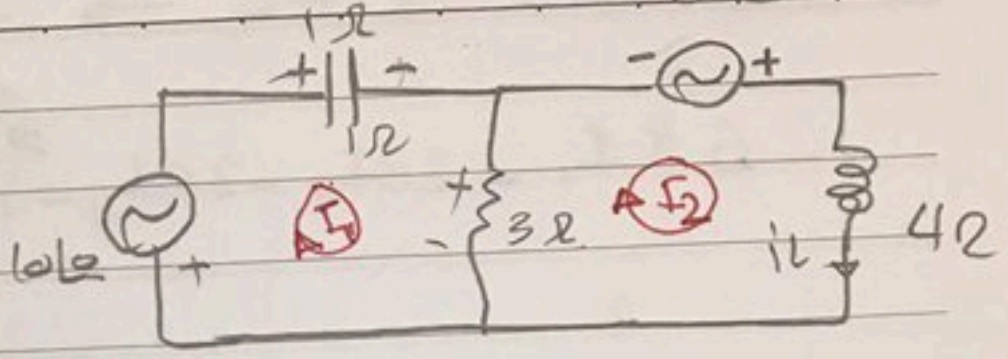
$$-I_1 R_2 + I_2 (R_2 + R_3 + R_4) = E_2$$



20/30

⊖ سعة الحثية

$$I_1 (3 - j1) - I_2 = -10 \angle 0^\circ$$



$$-3I_1 + (3 + j4)I_2 = 2 \angle 30^\circ$$

$$I_L - I_2 = 1 \angle 0^\circ$$

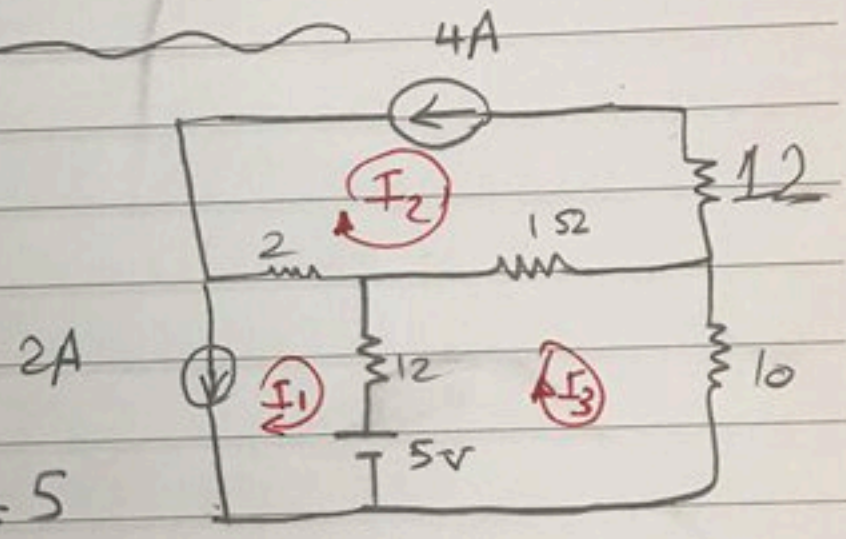
$$i_L = I_2 \sqrt{2} \sin(\omega t + \theta)$$

$$I_2 = -4A$$

$$I_1 = -2A$$

K.K.L at ③

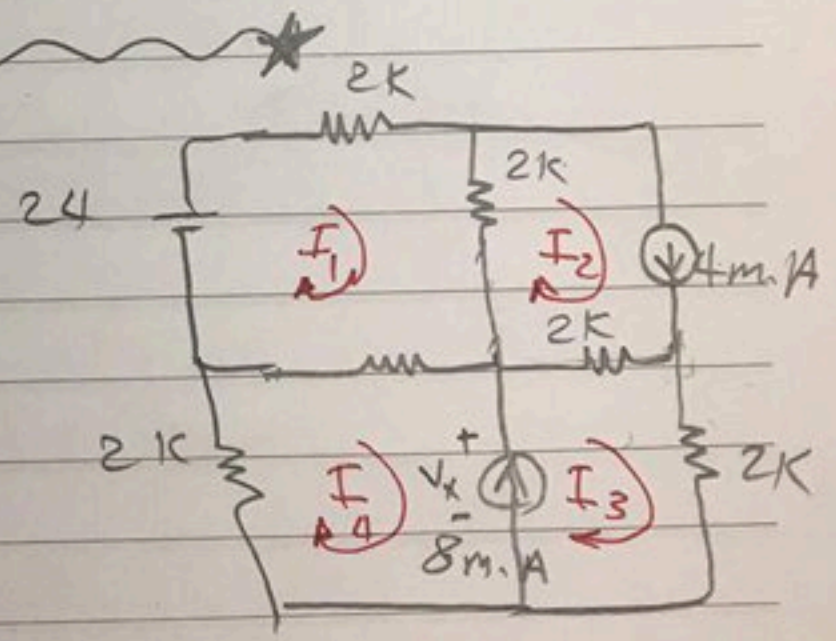
$$-12I_1 - 1I_2 + 23I_3 = 5$$



$$I_2 = 4mA$$

$$\Rightarrow 8mA = I_3 - I_4$$

وتشيل ال Current S  
ونعتبره من موجبة



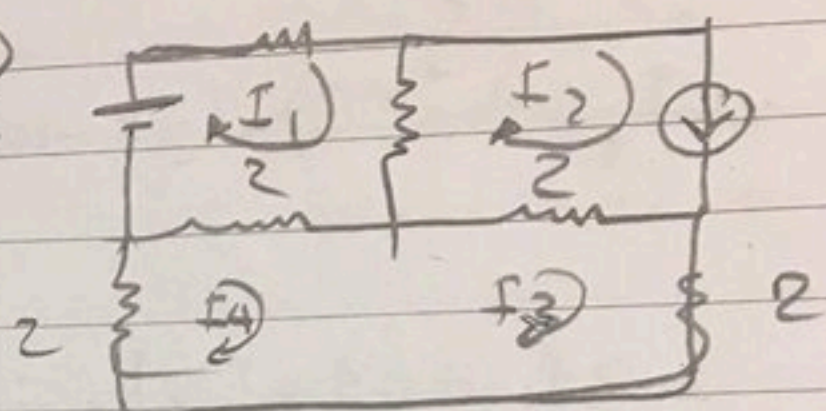


$$80 \text{ m.A} = I_3 - I_4 \rightarrow \textcircled{1}$$

$$-6kI_1 - 2kI_2 - 2kI_4 = 24 \rightarrow \textcircled{2}$$

$$-2kI_1 - 2kI_2 + 4I_4 + 4I_3 = 0$$

$\rightarrow \textcircled{3}$



منحل ٢١٥